

RF Exposure Compliance Requirements Guardian Analog Telemetry Radio Modem

FCC Rule: 1.1307, 1.1310, 2.1091 (b) (d), 2.1093

Description of Compliance:

The Guardian will be professionally installed in the SCADA (Supervisory Control And Data Acquisition) market and will be mounted with a fixed RTU (Remote Terminal Unit). A minimum separation distance listed in the table below must be maintained between the radiating structure and any person to classify as a mobile under FCC MPE regulations.

Antenna Gain vs. Recommended Safety Distance

	Antenna Gain		
	5 dBi	10 dBi	15 dBi
Min Safety Distance (max power)	105.7cm	188 cm	334.3 cm

Note: It is the responsibility of the user to guarantee compliance with the FCC MPE regulations when operating this device in a way other than described above.

The calculation for the more stringent specification, a General Population/Uncontrolled Mobile device according to section 2.1091(b) and section 1.1310 Note 2 is shown below:

Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (mins)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f (MHz)/1500 (MHz)	30
1500-100000	---	---	1.0	30

Environmental Specification: $f(\text{MHz})/(1500 \text{ mW}/\text{cm}^2)$
 $406.1 \text{ MHz}/(1500 \text{ MHz mW}/\text{cm}^2) = 0.27 \text{ mW}/\text{cm}^2$ (worst case)

$$S = (PG)/(4\pi R^2) \quad (\text{OET Bulletin 65})$$

Where:

S = Power Density (mW/cm²)

P = Power input to the antenna (mW)

G = Power Gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna (cm)

Distance Calculation for 5dBi antenna:

$$R = \sqrt{\frac{(PG)}{(4\pi S)}}$$

$$\begin{aligned} \text{Antenna Gain: } 5.0 \text{ dBi} & \quad 10^{(5 \text{ dBi}/10)} = 3.16 \\ \text{Power input to the Antenna: } 40.8 \text{ dBm} & = 10^{(40.8 \text{ dBm}/10)} = 12000 \text{ mW} \end{aligned}$$

$$R = \sqrt{\frac{(12000 \text{ mW} * 3.16)}{(4\pi * 0.27 \text{ mW/cm}^2)}} = 105.7 \text{ cm (Minimum Distance)}$$

Distance Calculation for 10dBi antenna:

$$R = \sqrt{\frac{(PG)}{(4\pi S)}}$$

$$\begin{aligned} \text{Antenna Gain: } 10.0 \text{ dBi} & \quad 10^{(10 \text{ dBi}/10)} = 10 \\ \text{Power input to the Antenna: } 40.8 \text{ dBm} & = 10^{(40.8 \text{ dBm}/10)} = 12000 \text{ mW} \end{aligned}$$

$$R = \sqrt{\frac{(12000 \text{ mW} * 10)}{(4\pi * 0.27 \text{ mW/cm}^2)}} = 188 \text{ cm (Minimum Distance)}$$

Distance Calculation for 15dBi antenna:

$$R = \sqrt{\frac{(PG)}{(4\pi S)}}$$

$$\begin{aligned} \text{Antenna Gain: } 15.0 \text{ dBi} & \quad 10^{(15 \text{ dBi}/10)} = 31.6 \\ \text{Power input to the Antenna: } 40.8 \text{ dBm} & = 10^{(40.8 \text{ dBm}/10)} = 12000 \text{ mW} \end{aligned}$$

$$R = \sqrt{\frac{(12000 \text{ mW} * 31.6)}{(4\pi * 0.27 \text{ mW/cm}^2)}} = 334.3 \text{ cm (Minimum Distance)}$$